

# PORTSMOUTH

## ENVIRONMENTAL MANAGEMENT PROGRAM



SEPTEMBER 2010

# PORTSMOUTH



*Circa Early 1950s*

## *Site Overview*

- The Portsmouth Gaseous Diffusion Plant was built between 1952 and 1956 by the Atomic Energy Commission as the last of three gaseous diffusion plants (Oak Ridge, TN and Paducah, KY) constructed to enrich uranium for supporting the nation's nuclear weapons program and later for commercial reactors.
- The plant is located on a 3,777-acre federal reservation in a rural area of southern Ohio, just south of the village of Piketon; approximately 22 miles north of the Ohio River and 75 miles south of Columbus.

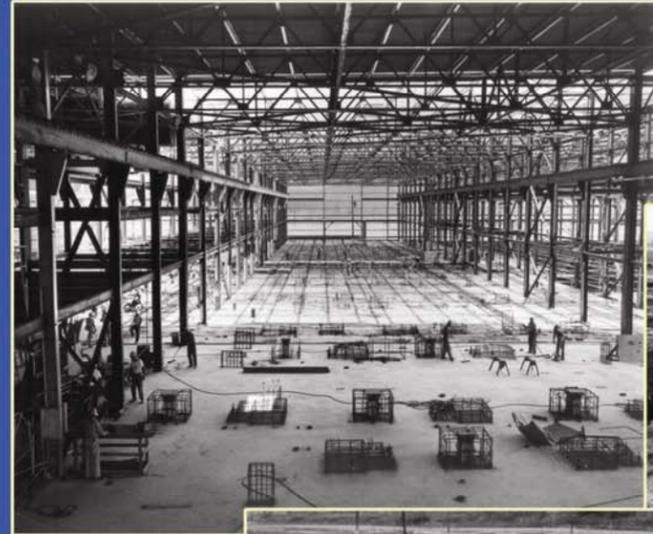
**Kentucky**



# Ohio

★ COLUMBUS

★ PORTSMOUTH  
★ GASEOUS DIFFUSION  
PLANT



*Circa Early 1950s*

- Operations spanned nearly 50 years. Production ended in 2001 and the plant is now in Cold Shutdown preparing for future decontamination and decommissioning (D&D).
- The facility is one of the largest employers in the region. Current employment is approximately 2,700 workers.

OVERVIEW

# PORTSMOUTH

## *Plant History*



**1950s:** As many as 22,500 workers were hired during peak construction of the Portsmouth plant in the summer of 1954. The plant was built at a cost of \$750 million, much less than the estimated \$1.2 billion construction cost. Portsmouth and its sister plant in Paducah, Kentucky, worked in tandem to enrich uranium. Paducah enriched uranium up to 2.75% Uranium-235 and then shipped the material to Portsmouth for further enrichment.

**1960s:** Production of highly enriched uranium (HEU) for the weapons program was discontinued.

**1989:** The Department of Energy signs agreements with the state of Ohio and the U.S. Environmental Protection Agency, initiating the Environmental Management Program to clean up contamination resulting from years of operations.

**1991:** All highly enriched uranium production was suspended at Portsmouth. The plant continued to enrich uranium for commercial nuclear power use until May 2001.

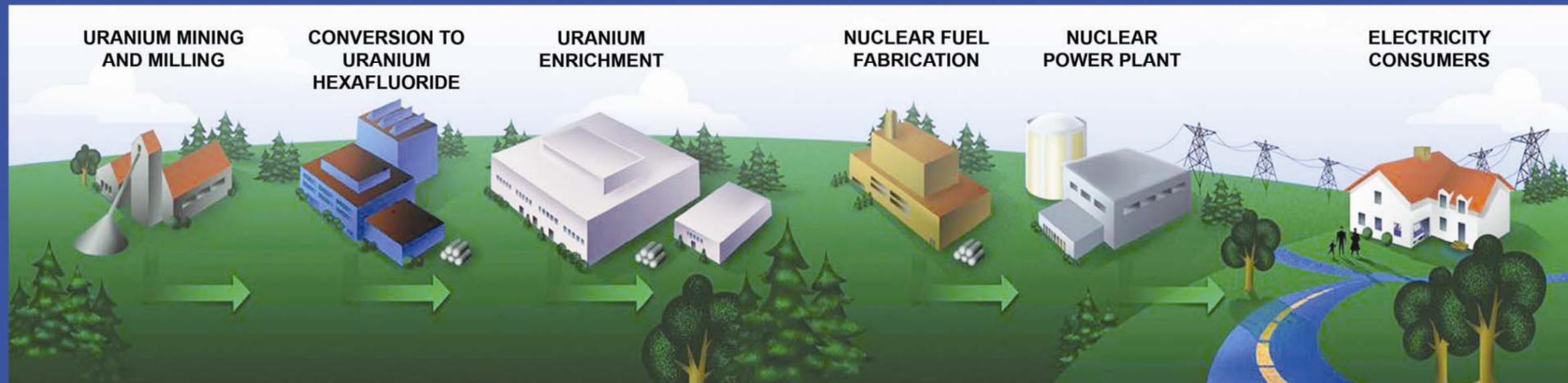


- 1993:** DOE leases production facilities at Portsmouth and Paducah to the United States Enrichment Corporation (USEC), established under the Energy Policy Act of 1992 to assume the uranium enrichment enterprise.
- 1998:** USEC is privatized and becomes USEC Inc., an investor-owned corporation.
- 2001:** USEC ceases enrichment activities at Portsmouth.
- 2004:** Portsmouth site is selected by USEC Inc. for the American Centrifuge Plant. Ground is broken for new conversion plants at Portsmouth and Paducah to convert the Department of Energy's inventory of depleted uranium hexafluoride to a more stable uranium oxide material.
- 2008:** Construction is completed on the Depleted Uranium Hexafluoride (DUF<sub>6</sub>) Conversion Plant at Portsmouth.
- 2010:** After extensive testing and operational readiness reviews, DUF<sub>6</sub> hot functional testing commences.
- 2010:** DOE awards Decontamination and Decommissioning (D&D) contract for the Portsmouth Gaseous Diffusion Plant. The five-year contract with an additional five-year option is awarded in August and is valued at approximately \$2B.

# PORTSMOUTH

## *Nuclear Fuel Cycle*

This diagram shows how nuclear power's basic element - uranium - makes its way from the ground into a nuclear power plant where it produces about 16% of the world's power and about 20% of the power used by consumers in the United States.

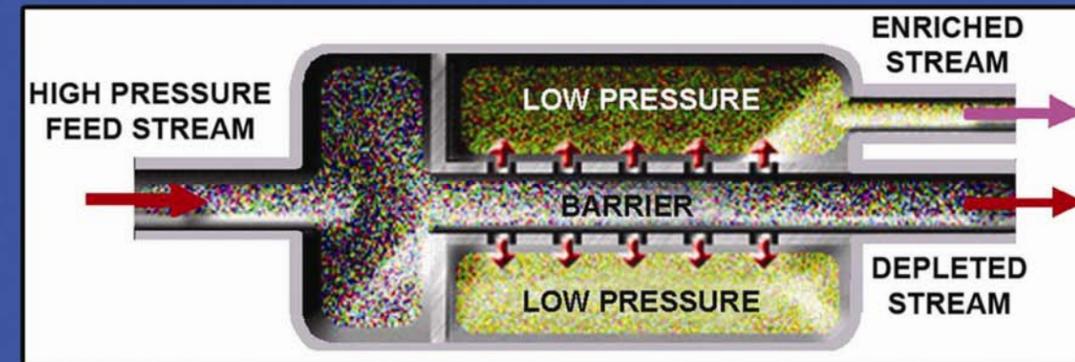


The enrichment process that was performed at Portsmouth until 2001 was the third step of the nuclear cycle.



# *Gaseous Diffusion Process*

The gaseous diffusion technology separates the lighter Uranium-235 isotopes from the heavier Uranium-238. The gas is forced through a series of porous membranes (barriers) with microscopic openings. Because the U-235 is lighter, it moves through the barriers more easily. As the gas moves, the two isotopes are separated, increasing the U-235 concentration (enriched stream) and decreasing the concentration of U-238.



A set of enrichment equipment, known as a “stage,” includes an electric motor powering a compressor that forces the gas through the barriers located in the converter.

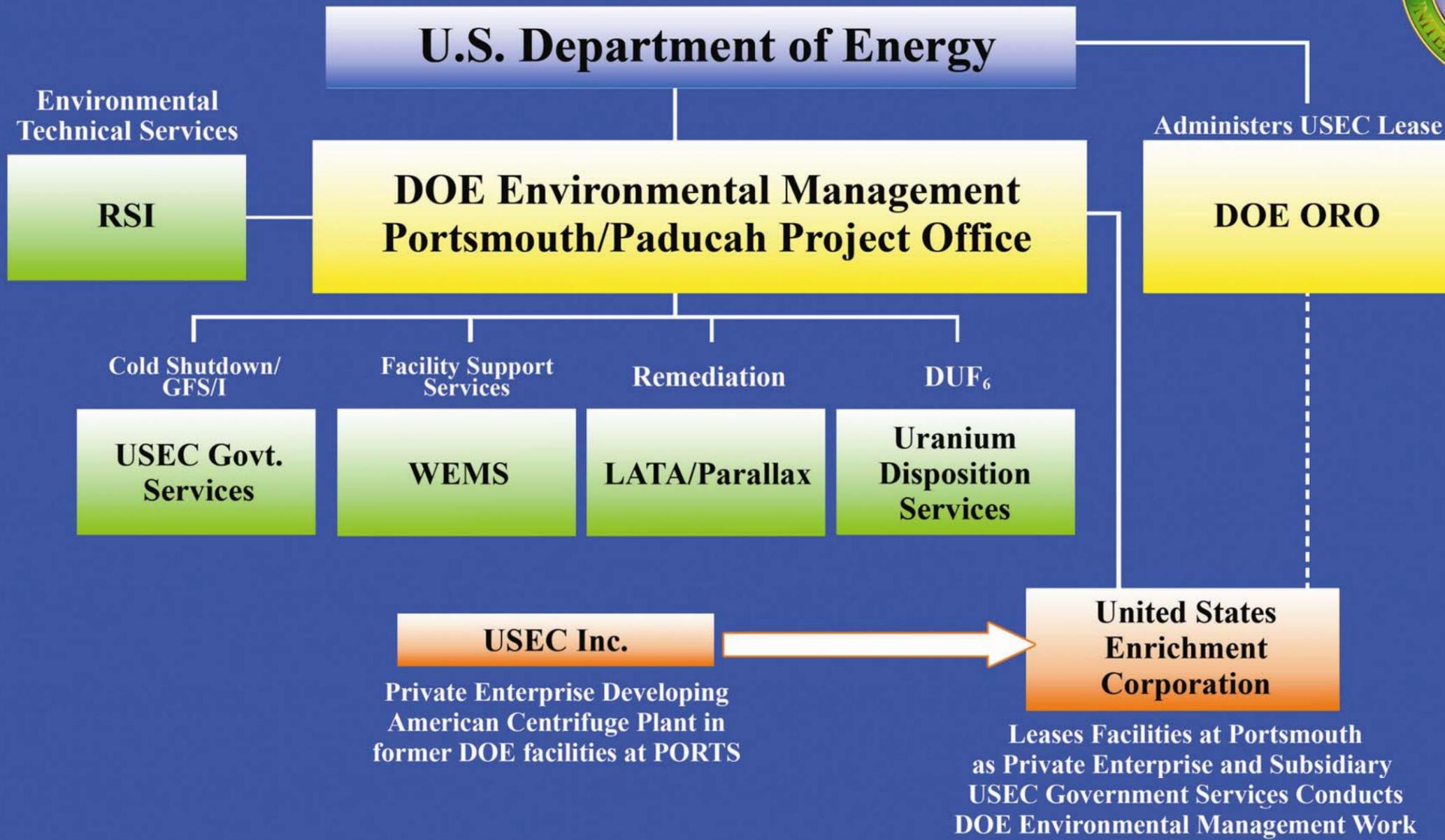
The advanced centrifuge technology being developed by USEC Inc. at Portsmouth is a significantly more energy-efficient enrichment technology than the gaseous diffusion process, using 95% less electrical power for operations.

# PORTSMOUTH

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## *Site Interface Responsibilities*

- ◆ **DOE Environmental Management Portsmouth/Paducah Project Office:** Landlord management, future D&D of gaseous diffusion plant, waste disposition, environmental remediation.
- ◆ **DOE Oak Ridge Operations:** Administration of United States Enrichment Corporation (USEC) lease.
- ◆ **USEC Inc.:** Lease of facilities, DOE contract work through subsidiary USEC Corp.; private enterprise developing American Centrifuge Plant.
- ◆ **USEC Corporation (Government Services):** Cold Shutdown, Technetium-99 removal from uranium feed material under DOE contract.
- ◆ **Wastren-EnergX Mission Support, LLC (Facility Support Services):** Information technology, security, property & records management, maintenance for DOE facilities.
- ◆ **LATA/Parallax Portsmouth (Environmental Remediation):** Groundwater & soil remediation, HEU disposition, legacy waste removal, inactive facility removal, environmental monitoring, Recovery Act work.
- ◆ **Uranium Disposition Services:** Design, build and operate DUF<sub>6</sub> conversion plant.
- ◆ **Restoration Services Inc.:** Environmental technical support to DOE.



**SITE INTERFACES**

# PORTSMOUTH

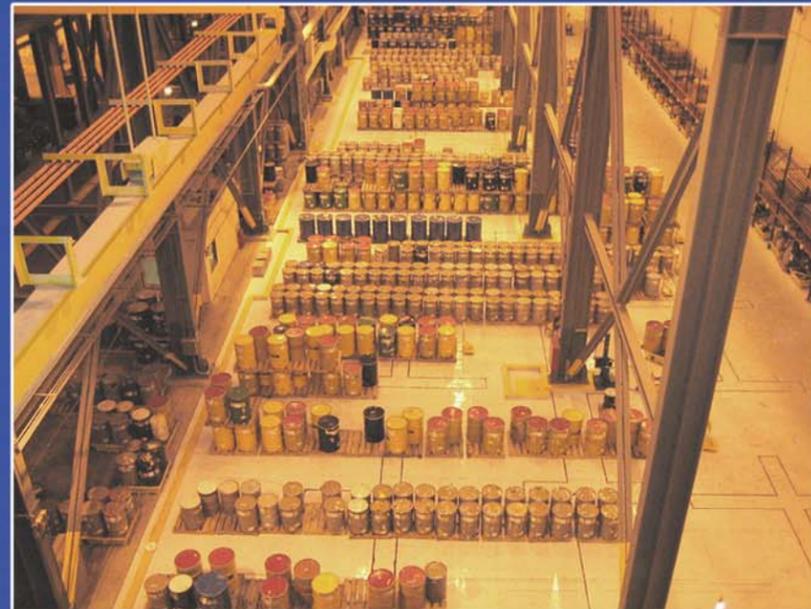
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## *Major Accomplishments*

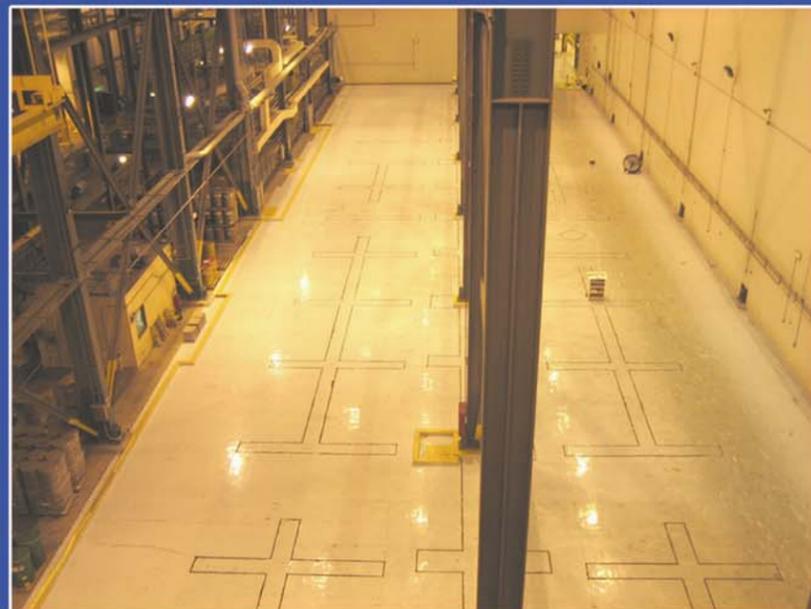
Since initiating the Environmental Management Program at Portsmouth, the Department of Energy has made extensive progress:

- Removed more than 10,000 tons of radioactively-contaminated scrap metal
- Closed and capped all 5 on-site landfills
- Demolished 23 total inactive facilities dispositioning more than 437,000 square feet of structures
- Completed project to clean 15,000 metric tons of out-of-specification uranium contaminated with technetium for re-use in nuclear industry
- Implemented treatments at all 5 identified on-site groundwater plume areas





**Waste Storage Facility: Before & After**



- **Emptied waste storage facility of 49,000 legacy waste containers for re-use by the American Centrifuge Plant**
- **Removed 1,300 old centrifuge machines and equipment so facilities could be made available for the commercial centrifuge program**
- **Completed removal of more than 5.7 million pounds of lubricating and transformer oils from the gaseous diffusion process buildings**
- **Accelerated deactivation activities and uranium deposit removals as part of Cold Shutdown of GDP**
- **Implemented all major environmental remedial actions prior to plant D&D**

**MAJOR ACCOMPLISHMENTS**

# PORTSMOUTH



*Lagoon containing chromium sludge was remediated in the early 1990s.*



## *Environmental Remediation*

The Portsmouth plant site was divided into quadrants for investigation of environmental contamination from past operations. Investigations conducted under the Resource Conservation and Recovery Act in the early 1990s identified five distinct areas, or plumes, of groundwater contaminated primarily with trichloroethene (TCE) and to a lesser extent, uranium, technetium, PCBs and metals. TCE was a common industrial solvent formerly used at the plant to degrease large equipment. The Portsmouth site is not on the National Priority List for cleanup.

Significant progress has been achieved on the Environmental Management Program. All major environmental remedial cleanup actions have been implemented prior to the upcoming plant D&D.

*Air monitoring stations are checked on a weekly basis to ensure air quality surrounding the plant site meets required standards.*

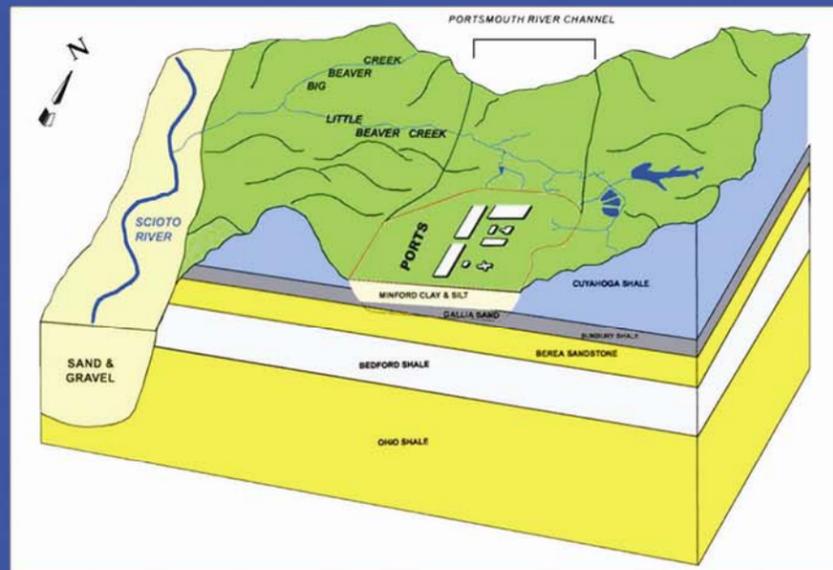
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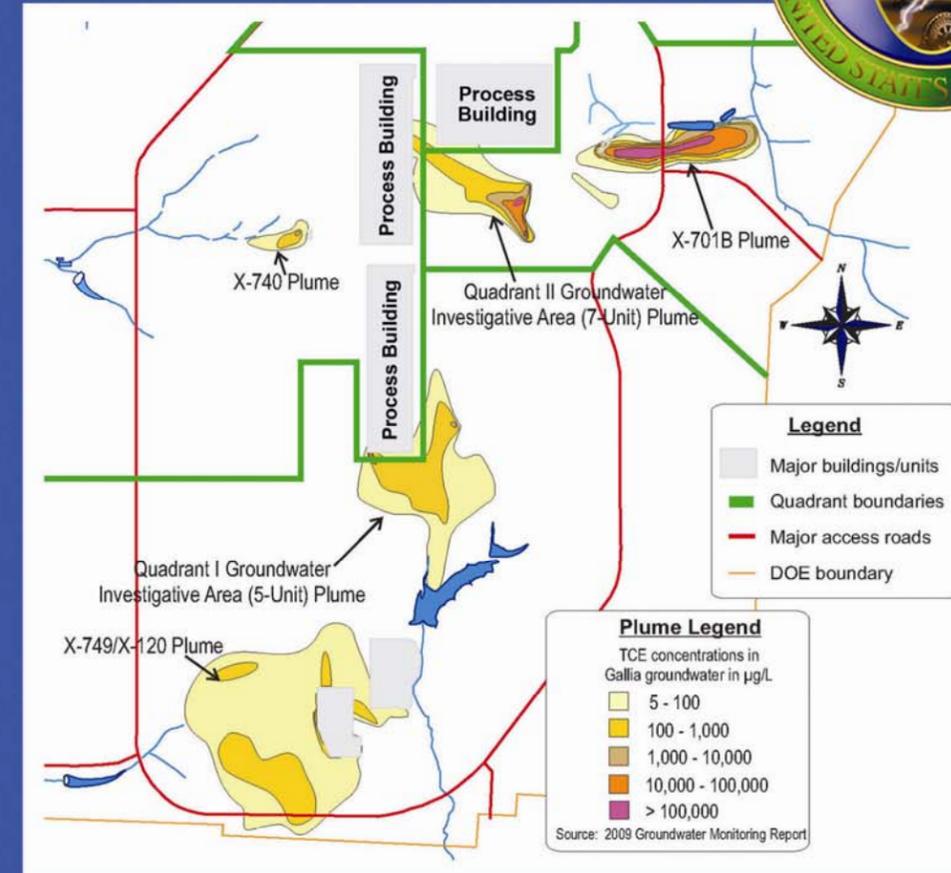


All five on-site landfills have been closed and capped in accordance with the regulatory requirements. Four groundwater treatment facilities are treating 28M gallons/year from the five on-site groundwater plume areas.

More than 1,000 groundwater monitoring wells have been installed around the plant site to investigate the groundwater; about 600 monitoring wells are sampled regularly.



### Groundwater Plume Areas



Based on the geology at the plant, there are two aquifers beneath the surface - the Gallia and Berea. Neither aquifer is being used for drinking water at the site.

# PORTSMOUTH

## Inactive Facility Removals



1. X-230J-8 Environmental Storage Building



2. X-230J-1 Environmental Monitoring Station



3. X-740 Waste Oil Storage Facility



4. X-106B Old Fire Training Facility



5. X-616 Effluent Control Facility



6. X-615 Sanitary Sewer Treatment Facility



7. X-344E Gas Ventilation Stack



8. X-344F Safety Building



9. X-344C Hydrogen Fluoride Storage Building



10. X-342C Waste Hydrogen Fluoride Neutralization Pit



11. X-701D Water Deionization Building



12. X-720A Maintenance and Stores Gas Manifold Shed



13. X-105 Electronic Maintenance Building



14. X-770 Mechanical Test Building



15. X-744T Lithium Storage Warehouse



16. X-744U Lithium Storage Warehouse



17. X-746 Shipping and Receiving Building

Seventeen inactive facilities were removed between 2006 and 2009. Removal of those facilities reduces the site risks and eliminates long-term surveillance and maintenance costs for the Department of Energy.



\*Facilities were located beyond edges of map



# *Inactive Facility Removals*



**1. X-103 Auxiliary Office Building**



**2. X-230J-9 N. Environmental Sampling Building**



**3. X-334 Transformer Storage and Cleaning Building**



**4. X-344B Maintenance Storage Building**



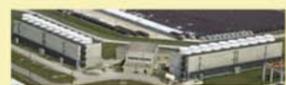
**5. X-605H Booster Pump House**



**6. X-605I Chlorinator Building**



**7. X-605J Diesel Generator Building**



**8. X-630 Recirculating Cooling Water Tower Complex**

The above-grade demolition of eight additional structures is scheduled to be complete by February 28, 2011.



**FACILITY REMOVALS**

# PORTSMOUTH

## *Depleted Uranium Hexafluoride (DUF<sub>6</sub>) Conversion Plant*

Public Laws 105-204 (July 1998) and 107-206 (August 2, 2002) authorized DOE to proceed with plans and award a contract to construct two conversion plants - at Portsmouth and at the Paducah site - to safely convert more than 700,000 metric tons of DUF<sub>6</sub> generated during uranium enrichment operations at the two facilities and at the gaseous diffusion plant in Oak Ridge,



Tennessee. About 6,000 cylinders of DUF<sub>6</sub> were shipped from Oak Ridge for future conversion through the Portsmouth DUF<sub>6</sub> plant.



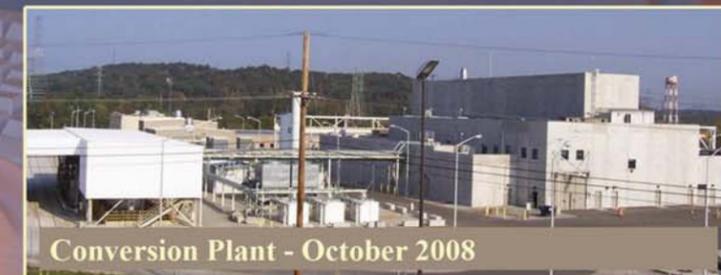
*Officials gathered for the plant's groundbreaking ceremony on July 28, 2004 (above). Below, the Portsmouth facility is pictured after completion of construction in May 2008.*





## KEY FACTS:

- Contract awarded August 2002 to Uranium Disposition Services to design, construct and operate conversion facilities
- Groundbreaking at Portsmouth held July 28, 2004
- Physical construction completed May 2008 at Portsmouth
- Hot functional testing operations begin in 2010
- Projected to require 18 years to complete conversion of Portsmouth DUF<sub>6</sub> inventory
- Employment - 240 during peak construction; 160 during operations



DUF<sub>6</sub> CONVERSION PLANT

# PORTSMOUTH

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## *American Recovery and Reinvestment Act*

In mid-2009, the Portsmouth Site's cleanup program was allocated \$118.2 million in funding under the American Recovery and Reinvestment Act (ARRA) to help jump-start the local economy and provide needed jobs in southern Ohio.

Five “shovel ready” projects were identified for accelerated cleanup; more than 400 workers were hired to complete the projects:

- ♦ Decontamination and decommissioning (D&D) of an 18-acre electrical switchyard;
- ♦ D&D of a 21-acre cooling tower complex;
- ♦ D&D of an 8,000 ft<sup>2</sup> chemical engineering building;
- ♦ Repackaging and disposition of approximately 2,900 metric tons of surplus uranium materials; and
- ♦ Excavation and treatment of contaminated soils in a trichloroethene (TCE)-contaminated groundwater source area.





# *American Recovery and Reinvestment Act : X-633 Recirculating Cooling Water Tower Complex*

The first project funded by the American Recovery and Reinvestment Act to be completed at the Portsmouth site was demolition of the 21-acre X-633 complex, an \$11 million project completed on schedule in June 2010.

The complex consisted of four separate cooling towers - two built in 1954 and two constructed in the late 1970s - and a pump house designed to remove heat generated during the uranium enrichment operations that took place between 1954 and 2001. Approximately 689 million gallons of water re-circulated through the four cooling towers on a daily basis during plant operations.

Demolition of the complex resulted in disposition of more than 738,000 cubic feet of waste, with another 525 tons of materials undergoing evaluation for potential reuse/recycling.



ARRA PROJECTS

# PORTSMOUTH

## *American Recovery and Reinvestment Act X-760 Chemical Engineering Building*

Built in 1954, the Chemical Engineering Building was formerly used for pilot and bench scale studies on uranium-bearing materials and chemicals. The facility also contained a laboratory to prepare environmental samples for analysis.

The leased building was returned to the Department of Energy in August 2009 and declared excess due to deteriorating conditions and radiological contamination within the building.

With \$9.5 million in funding through the American Recovery and Reinvestment Act, the X-760 facility was demolished on schedule on June 14, 2010, resulting in an 8,000-square-foot footprint reduction at the site. Fifty-seven intermodal containers totaling 840 cubic meters of debris from the project were shipped by rail to a licensed disposal site in Utah.





# *American Recovery and Reinvestment Act : X-701B Groundwater Plume Source Removal*

Post-treatment sampling shows >95% success rate in reducing contamination levels at the X-701B groundwater plume source removal area, funded by the American Recovery and Reinvestment Act. The project mixes sodium persulfate oxidant into a 42,000 square foot area of soils approximately 30 feet beneath the surface. The soils are contaminated with trichloroethene (TCE), used as a degreaser during past plant operations.

The former X-701B Holding Pond neutralized/settled waste waters from cleaning facilities since plant operations began in 1954 until November 1988. The pond was dewatered in the early 1990s and several treatment technologies have been implemented at the site over the years.

A second phase of oxidant treatment was initiated in August 2010 on an additional 28,000 square foot area of the groundwater plume.



ARRA PROJECTS

# PORTSMOUTH

## *American Recovery and Reinvestment Act X-533 Electrical Switchyard Complex*

During operations from 1954 until being de-energized in November 2008, the X-533 switchyard received power at 345kV from the Ohio Valley Electric Corporation system then delivered it to switch houses for distribution to the X-333 Process Building and area auxiliaries. It was enough power on a daily basis to fill 12.5% of the electrical needs for the entire state of Ohio.

Demolition began in the 18-acre complex on February 11, 2010. A total of 192 towers, 18 large transformers, and numerous other structures are being removed through funding provided by the American Recovery and Reinvestment Act.

Completion of the project is scheduled for late 2010.



*An aerial view of the switchyard in 2006 (above) reveals the expanse of area to be removed. At right, one of the larger, 120-foot towers is brought to the ground on the switchyard's north side.*





# *American Recovery and Reinvestment Act : Repackaging and Disposition of Uranium Materials*

Another project funded by the American Recovery and Reinvestment Act is the removal of 2,900 metric tons of excess uranium materials from the Portsmouth site. The material designated for removal is separated into 15 lots (about 78% of the total excess materials inventory) stored in the the Uranium Management Center.

The uranium was received between 1999-2002 from the DOE's Fernald and Hanford sites and various universities to support site closure activities and consolidation of the surplus material.



*Material from Lot 2 included 185 T-hoppers of depleted uranium oxide (left) which left a noticeable change in the landscape following their removal (center). At right, an intermodal is loaded onto a truck in April 2010 for transport to the Nevada National Security Site, formerly known as the Nevada Test Site.*

# PORTSMOUTH

## *USEC Work For DOE*

Under contract to the Department of Energy, the United States Enrichment Corporation (USEC) has transitioned the Portsmouth plant from Cold Standby to Cold Shutdown and is deactivating equipment for future Decontamination and Decommissioning (D&D) of the gaseous diffusion plant facilities.

## *Cold Shutdown*

Cold Shutdown includes chemically removing uranium deposits in process piping, removal of PCB oils, lube oils and other activities to mitigate potential future health/waste hazards during final plant D&D.

A number of accelerated cleanup projects are being completed to remove excess equipment, relocate utilities, etc. to transition the plant to D&D.





# *Decontamination and Decommissioning*

DOE awarded the D&D contract on August 16, 2010. The contract is valued at \$2.1 billion over 10 years, which includes an initial five-year contract period and potential five-year extension.

The project will address D&D of the three massive uranium enrichment process buildings, encompassing more than 90 acres. Each process building is approximately one-half mile long and contains thousands of “stages” of uranium enrichment equipment.

The D&D project includes more than 130 buildings in total and will save and create jobs locally, building on the job creation resulting from the cleanup efforts to date.



**D&D PLANNING**

# PORTSMOUTH

## *Stakeholder Involvement*

The Department of Energy conducts periodic public informational meetings to provide updates on the Environmental Management Program. Annual site environmental reports are issued and a public website ([www.pppo.energy.gov](http://www.pppo.energy.gov)) is maintained with current project information.

### Stakeholder Groups at Portsmouth:

- *Portsmouth Environmental Management Site Specific Advisory Board (EM SSAB)*
- *Southern Ohio Diversification Initiative (SODI)*
- *Portsmouth/Piketon Residents for Environmental Safety and Security (PRESS)*
- *Southern Ohio Neighbors Group (SONG)*
- *Bristol Village Retirement Community*
- *United Steel Workers Union, SPFPA (Guard) Union, Tri-State Building Trades Council*



## KEY STAKEHOLDER ISSUES:

- Need for continued strong employment base
- Safe, environmental cleanup
- Future land use
- Historic preservation



*Left: The Site Specific Advisory Board provides recommendations to DOE on cleanup and future site use.*



*Left: Tours provide stakeholders and officials an opportunity to see on-going work at the site.*



*Site personnel are always pleased to welcome officials from local, state and federal levels of government.*



STAKEHOLDER INVOLVEMENT



**EM** Environmental Management

safety ♦ performance ♦ cleanup ♦ closure